

REMARKS

The application has been amended so as to place it in condition for allowance at the time of the next Official Action.

Claims 1, 2, 7-9, 15, 16 and 18-28 are present in the application.

Claims 1, 2 and 7-9 have been amended.

Claims 3-6 and 10-14 have been cancelled.

New claims 22-28 have been inserted.

Claims 1-4, 7-9 and 15 were rejected under 35 USC 103(a) as being unpatentable over HAMASAKI 4,507,540 in view of CHURCH 4,572,942 and STEEN 4,167,662. Claims 1 and 13 were rejected under 35 USC 103(a) as being unpatentable over HAMASAKI in view of JP 55-24739 (JP '739) and STEEN. Claims 1, 10 and 12 were rejected under 35 USC 103(a) as being unpatentable over HAMASAKI in view of MEEHAN, deceased et al. 3,939,323 and STEEN. Claims 1, 5, 6 and 11 were rejected under 35 USC 103(a) as being unpatentable over HASHIMOTO et al. 6,034,343 in view of EP 0 639 423 (EP '423) and STEEN. Claims 1 and 14 were rejected under 35 USC 103(a) as being unpatentable over HASHIMOTO et al. in view of GB 1 358 985 (GB '985) and STEEN. Claim 20 was rejected under 35 USC 103(a) as being unpatentable over HASHIMOTO et al. in view of GB '985 and STEEN and further in view of COOK 2,790,656. Claims 16, 18, 19 and 21 were rejected under 35 USC 103(a) as being unpatentable over HASHIMOTO et al. in view of GB '985 and STEEN and further in view of BEYER et al. 5,821,493.

Claim 1 has been amended to recite that the workpiece or workpieces are made of steel and a ternary gas mixture consisting of argon, helium and either O<sub>2</sub> or CO<sub>2</sub>.

The tables on pages 12 and 13 of the specification indicate that very good results are obtained when using such ternary gas mixtures for welding either carbon steel or stainless steel pieces. These results have been confirmed in an article recently published by The Welding Institute (copy enclosed), where The Welding Institute clearly recommends the use of ternary mixtures consisting of argon, helium and CO<sub>2</sub> for hybrid laser-arc welding, in order to improve the penetration and the welding speed.

None of the applied prior art documents describe or render obvious to one of ordinary skill in the art the use of a ternary gas mixture consisting of argon, helium and either O<sub>2</sub> or CO<sub>2</sub> for hybrid welding of steel pieces.

HAMASAKI describes a process of hybrid welding of steel pieces using various gas mixtures. The gas mixtures described by HAMASAKI include helium and O<sub>2</sub>, helium and argon, CO<sub>2</sub> and helium, and CO<sub>2</sub> and argon. HAMASAKI fails to describe either a ternary gas mixture or specific amounts of the different gases of the gas mixtures.

CHURCH describes a process of MIG welding ferrous plates using a quaternary gas composition that contains argon, helium, CO<sub>2</sub> and O<sub>2</sub>. In sharp contrast to applicants' claimed

inventive method, CHURCH requires both O<sub>2</sub> and CO<sub>2</sub> in the gas mixture (column 4, lines 49-60).

STEEN describes a hybrid welding process using an inert gas for welding and O<sub>2</sub> for cutting (column 4, lines 16-20 and 34-35).

JP '739 describes a process of welding steel using a gas composition containing 0.2-5% nitrogen and at least two of argon, helium and CO<sub>2</sub>. The ternary gas mixture in applicants' claimed inventive method excludes the nitrogen required in the gas composition described by JP '739.

MEEHAN, deceased et al. describe a process of laser welding steel using binary gas mixtures which do not contain argon. See column 1, lines 60-63 and column 2, lines 15 and 16 of MEEHAN, deceased et al.

HASHIMOTO et al. describe a hybrid welding apparatus but fail to describe any gas compositions.

EP '423 describes gas mixtures containing argon and/or helium and either CO<sub>2</sub> or O<sub>2</sub> for welding aluminum and non-ferrous metals. In sharp contrast to EP '423, applicants' claimed inventive process is directed to the welding of steel and the use of a ternary gas mixture containing both argon and helium.

GB '985 describes a ternary gas mixture for arc welding stainless steel. The gas mixture contains argon, O<sub>2</sub> and CO<sub>2</sub>. The gas mixture described by GB '985 requires both O<sub>2</sub> and CO<sub>2</sub> and does not contain helium.

COOK describes welding aluminum to steel or copper. COOK describes either a shield gas of argon or helium (column 6, lines 8-12).

BEYER et al. describe a process of hybrid welding but fail to describe any gas compositions.

Again, none of the applied prior art references describe the use of a ternary gas mixture consisting of argon, helium and either O<sub>2</sub> or CO<sub>2</sub> in a process of hybrid welding steel pieces according to applicants' claimed inventive process.

Applicants further submit that the claimed inventive process would not have been obvious to one of ordinary skill in the art over any combination of the applied prior art references.

EP '423 describes gas mixtures used in the welding of aluminum and non-ferrous metals in contrast to the welding of steel pieces recited in applicants' claimed inventive process.

Applicants further submit that it would not have been obvious to modify the gas mixtures described by the applied prior art references to render obvious the ternary gas mixture recited in the claims. For example, there is no motivation to modify the quaternary gas mixture described by CHURCH to obtain the ternary gas mixture recited in the claimed inventive process. Likewise, there would be no motivation to remove the nitrogen from the gas composition described by JP '739.

In view of the above amendments and remarks, applicants respectfully submit that claims 1, 2, 7-9, 15, 16 and 18-21 would

not have been obvious to one of ordinary skill in the art under 35 USC 103(a) over HAMASAKI, CHURCH, STEEN, JP '739, MEEHAN, deceased et al., HASHIMOTO et al., EP '423, GB '985, COOK, BEYER et al. and any combination thereof.

Claim 22 is directed to the subject matter set forth in original claim 17 and is believed to be allowable for the same reasons set forth in regard to claim 1.

Claims 23-28 are directed to the processes and the gas mixture compositions described in the fourth example on page 12 and the first and second examples on page 13 of the specification.

Applicants respectfully submit that the processes and gas mixtures recited in claims 23-28 are also allowable for the same reasons set forth in regard to claims 1, 2, 7-9, 15, 16 and 18-21.

In light of the above amendments and remarks, applicants believe that the present application is in condition for allowance and an early indication of the same is respectfully requested.

If the Examiner has any questions or requires clarification of any of the above points, the Examiner may contact the undersigned agent so that this application may continue to be expeditiously advanced.

BRIAND et al. S.N. 09/870,014

Attached hereto is a marked-up version of the changes made to the claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (twice amended) A process for welding one or more metal workpieces to be joined together by producing at least one welded joint between edges to be welded of said metal workpiece or workpieces, said workpiece or workpieces being made of steel, by using at least one laser beam and at least one electric arc, in which process, during welding of the joint, shielding at least one part of a welding zone comprising at least one part of said welded joint during welding with at least one shielding atmosphere formed by a ternary gas mixture consisting of:

argon;

[- argon and/or] helium, the argon and the helium with a content greater than or equal to 70% by volume; and

[- at least one additional compound chosen from H<sub>2</sub>,]

a third gas consisting of O<sub>2</sub>[,] or CO<sub>2</sub> [and N<sub>2</sub>] with a content of [0] non zero to 30% by volume[, and

wherein the at least one electric arc is generated by a non-consumable electrode].

Claim 2 has been amended as follows:

2. (twice amended) The welding process as claimed in claim 1, wherein the content of [at least one additional compound

chosen from H<sub>2</sub>,] O<sub>2</sub>[,] or CO<sub>2</sub> [and N<sub>2</sub>] is non zero and less than or equal to 20% by volume.

Claim 7 has been amended as follows:

7. (thrice amended) The welding process as claimed in claim 1, wherein the shielding atmosphere is formed by a gas mixture consisting of at least 70% by volume of helium and argon and of 0.1 to 30% by volume of [at least one additional compound chosen from H<sub>2</sub>,] O<sub>2</sub>[,] or CO<sub>2</sub> [and N<sub>2</sub>].

Claim 8 has been amended as follows:

8. (thrice amended) The welding process as claimed in claim 1, wherein the workpiece or workpieces to be welded are made of [a metal or a metal alloy chosen from] coated or uncoated steels[, aluminum or aluminum alloys].

Claim 9 has been amended as follows:

9. (thrice amended) The welding process as claimed in claim 1, wherein [the shielding atmosphere is formed by a gas mixture consisting of at least 70% by volume of helium and/or argon and of 0.1 to 30% by volume of at least one additional compound chosen from O<sub>2</sub> and CO<sub>2</sub> and wherein] the workpiece or workpieces to be welded are made of stainless steel or carbon steel.